Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-6: 760-765

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-6 pp. 760-765**
Journal homepage: http://www.ijcmas.com

Original Research Article

Study of Genetic Variability and Heritability among *Rabi* Sorghum Mutants (Cv. Parbhani Moti)

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A B S T R A C T

Mutation was induced in sorghum cultivar Parbhani Moti with the help of gamma rays and EMS. Mutants from different eight mutagenic treatments viz., T1 (10kR), T2 (20kR), T3 (30kR) were gamma rays treatments and T4 (0.1%), T5 (0.2%), T6 (0.3%) and T7 (0.4%) were EMS treatments and T8 (10kR + 0.1% EMS) with two control treatments viz., T9 (wet control) and T10 (dry control) were evaluated for variability, heritability and genetic advance using thirteen different yield and its attributing traits. The high genotypic and phenotypic coefficient of variation was observed for the traits viz., grain yield per plant, number of grains per primary, harvest index and total biomass content. High heritability estimates coupled with high expected genetic advance were observed for grain yield per plant, total biomass content and harvest index which indicate the presence of additive gene effect. These characters exhibiting high variability, heritability and genetic advance can be useful in *rabi* sorghum improvement program for enhancement in the yield.

Keywords

Sorghum mutants, Variability, Heritability and Genetic advance

Introduction

Sorghum (*Sorghum bicolor* L. Moench) is a staple cereal grown in both rainy (*kharif*) and post rainy (*rabi*) seasons in the semi-arid parts of India, especially in marginal areas with least fertile and low water holding capacity soils where, only few other crops can survive. It is also an important source of green and dry fodder crop for animals. With the increase in human and animal population and a fragile balance between food supply and demand for it, production of sorghum must be increased to meet the current and future food and fodder needs.

Knowledge of genetic variability, heritability and genetic advance is prerequisite for initiating appropriate breeding programme for improvement in any crop. The heritable variation is masked by non-heritable variation which creates difficulties in exercising selection. Hence, it becomes necessary to spot over all variability into heritable and non-heritable components with the help of certain genetic parameters. Since many character of economic importance are highly influenced by environmental conditions, progress in any breeding programme is mainly depends upon the magnitude of genetic variability present in the population. Hence in present investigation efforts have been made to analyze sorghum mutants for components of variability, heritability and genetic advance.

Materials and Methods

Eight different mutagenic treatments of Parbhani Moti viz., T1 (10kR), T2 (20kR), T3 (30kR) were gamma rays treatments and T4 (0.1%), T5 (0.2%), T6 (0.3%) and T7 (0.4%) were EMS treatments and T8 (10kR + 0.1% EMS) obtained from B.A.R.C. Trombay, Mumbai, along with two control treatments viz., T9 (dry control) and T10 (wet control) were sown in *Randomized Block Design* with 3 replications, at spacing of 15 cm within plants and 45 cm between plants in M_2 at the field of Sorghum Research Station, VNMKV Parbhani during *rabi* 2016.

The observations were taken on selected 10 plants from each treatment. The treatments along with checks were studied for different thirteen yield and its attributing traits *viz.*, initial plant count, days to panicle initiation, days to 50 % flowering, days to maturity, plant height (cm), earhead length (cm), number of primaries per panicle, number of seeds per primary, fodder yield per plant (g), total biomass content (g), 100 seed weight (g), harvest index and grain yield per plant (g). Data collected was subjected to Statistical analysis for variability, heritability and genetic advance as suggested by Burton and Devane (1952), Lush (1949) and Johanson *et al.* (1955) respectively.

Results and Discussion

Analysis of variance revealed that the presence of significant differences among the genotypes for all the characters indicating the presence of sufficient amount of variability among these characters Table 1.

The genotypic and phenotypic coefficients of variation for various characters are presented in Table 2. Since most of the economic characters (grain yield) are complex in inheritance and are greatly influenced by several genes interacting with various environmental conditions, the study of phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) is not only useful for comparing the relative amount of phenotypic and genotypic variations among different traits but also very useful to estimate the scope for improvement by selection. However, the differences between genotypic and phenotypic coefficients of variability indicated the influence of environment in expressing the characters.

The PCVs were higher than the GCVs for all of the traits similar findings were given by Wani and Anis (2014) and Wani (2011), which indicated that those were influenced by environment. However, the differences were of lower magnitude for traits viz., initial plant count, days to panicle initiation, days to 50 % flowering, days to maturity, plant height and total biomass content (Fig.1), suggesting least influence of environment on the expression of these characters. The estimate of GCV and PCV alone is not of much helpful in determining the heritable portion. The amount of advance to be expected from selection can be achieved by estimating heritability along with coefficient of variability.

Burton (1952) suggested that GCV and heritability estimates gives better information on the efficiency of selection in breeding program. The estimates of heritability in broad sense and genetic advance for various characters have been given in Table 2. The heritability ranged from 46.2% (fodder yield/plant) to 99% (total biomass content). Desirable broad sense heritability (more than 60 percent) was observed for all the characters studied

except fodder yield/plant. These results have conformity with the results reported by Khaing Wah Htum *et al*., (2015), Anand and Kajidoni (2014). High heritability coupled with moderate expected genetic advance was observed for the traits initial plant count, days to 50% flowering, plant height (Anand and Kajidoni, 2014), number of primaries per panicle (Nang Htwe Kham *et al*., 2015), number of seeds per primary, 100 seed weight while high heritability coupled with low expected genetic advance was observed for the traits earhead length and days to maturity. Low heritability coupled with low genetic advance was observed for fodder yield/plant. High heritability coupled with high genetic advance was observed for grain yield per plant, total biomass content and harvest index indicating effectiveness for selection, based on phenotypic performance. Similar findings for grain yield per plant were reported by Khaing Wah Htum *et al*., (2015), Unche *et al*., (2008).

Table.1 Analysis of variance for yield and yield contributing characters in sorghum

Source of variation	d.f.	Mean sum of squares						
		Initial plant count	Days to panicle initiation	Days to 50% flowering	Days to maturity	Plant height (cm)	Earhead length (cm)	Number of primaries per panicle
		1	2	3	4	5	6	7
Replication	2	2.1	0.1	0.433	1.233	21.366	0.4503	1.754
Treatment	9	825.274**	40.163**	84.774**	33.574**	529.510**	2.1832**	27.077**
Error	18	7.625	0.841	3.618	0.971	36.127	0.209	1.843

Source of variation	d.f.	Mean sum of squares					
		Number of seeds per primary	Grain yield per plant (g)	100 seed weight (g)	Fodder yield per plant (g)	Total biomass content (g)	Harvest index
		8	9	10	11	12	13
Replication	2	2.7723	15.346	0.0102	337.818	10.744	42.851
Treatment	9	43.5008**	317.394**	0.2654**	849.95**	3766.767**	87.810**
Error	18	5.5012	10.558	0.0151	237.974	12.169	4.182

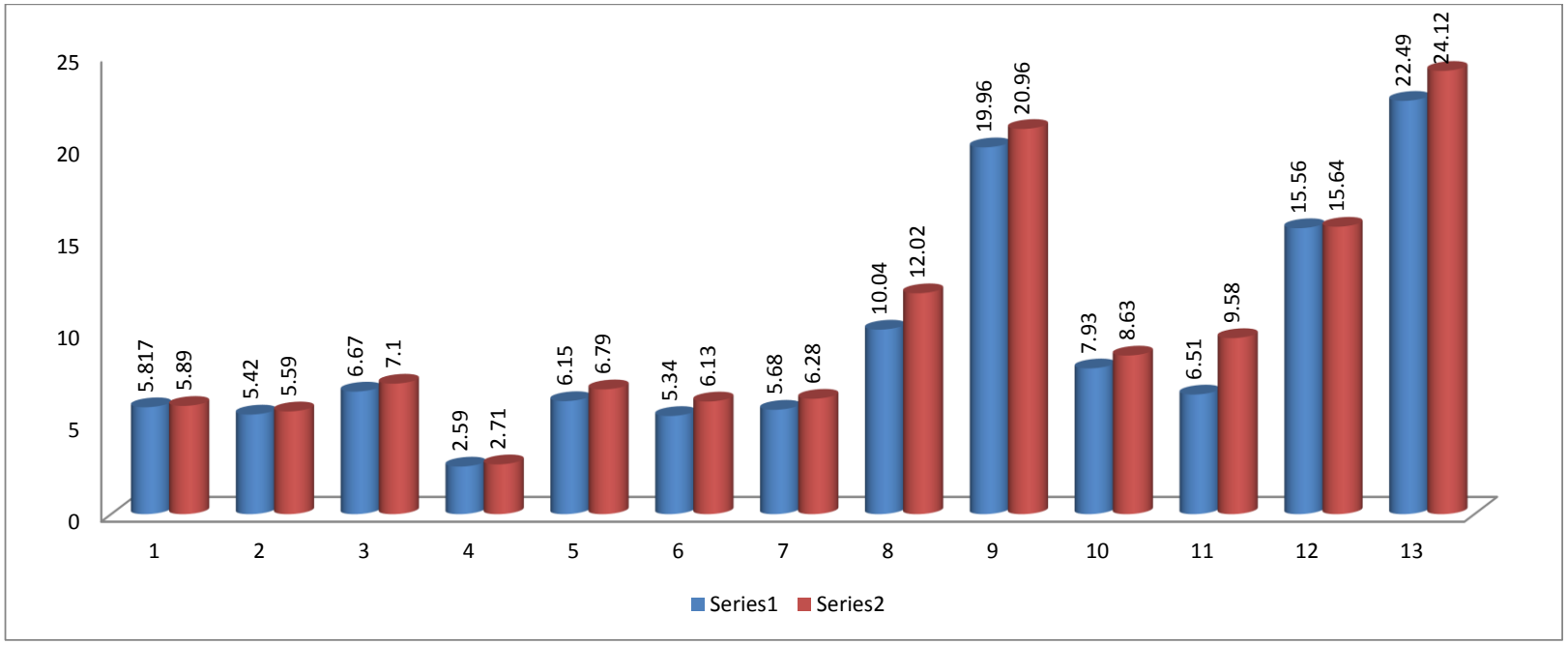
*and ** indicates significance at 5% and 1% level, respectively

Table.2 Genetic variability for yield and yield contributing characters in sorghum (cv. Parbhani Moti)

Sr. No.	Characters	Range	GM	GV (%) (σ^2g)	PV (%) (σ^2p)	GCV (%)	PCV (%)	Heritability (%)	Genetic advance	EGA (%)
1	**Initial plant count**	254-299.3333	283.80	272.552	280.17	5.817	5.89	97.3	33.54	11.81
2	**Days to panicle initiation**	59.67- 70.67	66.8	11.10	13.95	5.42	5.59	94.0	7.23	10.82
3	**Days to 50% flowering**	64-80.67	77.97	27.05	30.67	6.67	7.10	88.2	10.06	12.90
4	**Days to maturity**	118-129	127.17	10.86	11.84	2.59	2.71	91.8	6.50	5.12
5	**Plant height (cm)**	183.3-223	208.62	164.49	200.618	6.15	6.79	82.0	23.92	11.47
6	**Earhead length (cm)**	13.43-16.3	15.19	0.658	0.867	5.34	6.13	75.9	1.46	9.58
7	**No. of primaries per panicle**	47.83-56.9	51.01	8.411	10.255	5.68	6.28	82.0	5.41	10.61
8	**No. of seeds per primary**	27.7-39.7	35.45	12.67	18.168	10.04	12.02	69.7	6.12	17.27
9	**Grain yield per plant (g)**	36.97- 66	50.67	102.279	112.837	19.96	20.96	90.6	19.84	39.14
10	**100 seed weight (g)**	3.04- 3.91	3.63	0.083	0.098	7.93	8.63	84.5	0.55	15.03
11	**Fodder yield per plant (g)**	191.85-247.73	219.34	203.991	441.966	6.51	9.58	46.2	19.99	9.11
12	**Total biomass content (g)**	183.22-306.94	227.32	1251.533	1263.70	15.56	15.64	99.0	72.53	31.90
13	**Harvest index (%)**	15.93-31.69	23.48	27.90	32.088	22.49	24.12	87.0	10.15	43.20

Fig.1 Genotypic and Phenotypic coefficient of variation for Yield and yield contributing traits in sorghum

Fig.1. Genotypic and Phenotypic coefficient of variation for Yield and yield contributing traits in sorghum



1 Initial plant count
2 Days to panicle initiation
3 Days to 50% flowering
4 Days to maturity
5 Plant height
6 Earhead length
7 No. of primaries per panicle
8 No. of seeds per primary
9 Grain yield per plant
10 100 seed weight
11 Fodder yield per plant
12 Total biomass content
13 Harvest index

Series 1 = GCV
Series 2 = PCV

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